LEPROSY
WITH SPECIAL REFERENCE TO ITS OCCURENCE IN INDIA

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CONTENTS

FOREWORD

Leprosy is one of the great scourges which afflict India to-day, with a terrible toll of human life and suffering Very few books are found on Leprosy, but I think my friend and colleague Dr Malhotra has tackled the difficult problem of eradicating this disease in a more practical way in his little book It will prove instructive and interesting reading to both students and practitioners

I wish the book the widest circulation

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LEPROSY

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CHAPTER I

Introduction

Leprosy is a world disease It is to be found in all lands but it thrives most extensively in tropical and sub tropical districts During the middle ages, leprosy was common in Europe, but largely owing to improved methods of sanitation it is disappearing It still lingers, however, in Iceland and Norway Climate is not directly a determining factor in the distribution It has been stated very aptly that "Leprosy may be said to be determined by climate only so far as civilization is determined by climate"

Leprosy is not only a world disease, it is a world problem No very convincing solution is at hand as yet. There is great encouragement however, in the fact that

Governments are becoming *more* and *more* aware of the need of caring for the lepers and of preventing the spread of the disease

It has been stated that there are about 416,000 lepers in the British Empire and about 250,000 of these are to be found in India Recent survey work confirms the statement that in India alone the number of lepers is in the neighbourhood of one *million* *There are many people* who *suffer* from the disease for many years without knowing it, and sometimes when they do know it, they hide the fact Only the most obvious cases find their way into the census figures

Table showing Incidence of Leprosy in the British Empire

Area	Year	Total Number of Lepers	Per Million
India	1921	1,02,513	0 32
Ceylon	1921	577	0 13
Malay States	1921	450	0 34
British North Borneo	1919	54	–
Fiji	1920	450	–

Area	Year	Total Number of Lepers	Per Million
West Indies	1921	1,189	0 74
British Guiana	1924	247	0 83
Cyprus	1921	74	0 23
Africa —			
Nigeria	1921	32,000	3 20
Tanganyika	1924	11 480	2 80
Kenya	1922	2,018	0 74
Uganda	1919	3 000	1 00
S Rhodesia	1921	1 000	1 11
S Africa	1923	2,501	0-46
Mauritius	1923	600	1 60
Palestine	1902	600	0 86

Indo-China has very numerous lepers, Jeanselme in 1900 estimating them at 15 000 or 0 67 per million, for the whole area. Siam *is severely infected, mostly in the* Chinese district, 500 to 600 lepers being *known in* Bangkok, and the estimated *rate* is 2 per million, every town and village *having its leper quarter*

India presents an exceptional field for *studying leprosy in a hot country, owing to* the available five decades of census figures, and the *epidemiological* studies of Vandyke

Carter in Kathiawar, of Lewis and Cunningham in the Kumaon Hills, and of the India Leprosy Commission of 1891

The following Table shows the number of cases and the rates per million for all India

	All India			British India	
Year	Population	Lepers	Rate per million	Lepers	Rate per million
1872	188 281,169	108,807	0 54	101,590	0 55
1881	216,679,331	128,089	0 59	118,953	0 60
1891	274 373,929	126,244	0 50	110,509	0 56
1901	294,361,056	97,340	0 33	85,878	0 37
1911	315,156,396	109,094	0 35	92,433	0·38
1929	318,942,380	102,513	0 32	85,122	0 34

The decline in the incidence up to 1901 was largely owing to incorrectly returned leucoderma and syphilis cases, being excluded subsequently to 1891, and to a reduction due to severe famines between 1891 and 1901 It was followed by a slight rise in 1911, while the fall in 1921 was probably due to

influenza epidemic of 1918–19, so that the disease is fairly stationary, with a slight tendency to decrease, in spite of prophylactic measures being still very inadequate If early cases could be included, the total number would probably be at least doubled, but the same applies to the great majority of the figures for backward tropical countries, and to many more progressive ones The Indian Commission found no relationship between leprosy rates and either density of population, increase or decrease of the people race or religion and caste except that the poor suffer most, and that Hutchinson s statement that coastal and riverine areas are most affected was not true of India where hill areas suffer more than the plains

The problems that present themselves in the diagnosis and treatment of leprosy are practically the same the world over But in the effort to control and stamp out the disease, difficulties arise which vary

These differences are principally topographical and racial The methods and organisation which might be effective in thickly populated countries like India, and China would be quite unsuitable to the far flung and

widely separated communities of Africa, while the more backward the race, the greater the difficulty there is in persuading the victim to yield himself to treatment

So much progress has been made in the investigation of leprosy in the different countries of the world during the last few years that it has become urgently necessary to co ordinate leprosy teaching and procedure throughout the world The old view was "get rid of the leper' To day the slogan is "get rid of leprosy"

I have been working at the General Sadar Hospital, Jubbal State for the last ten years *In this hilly district leprosy is very* rife In my earlier years I conformed to the usual view that leprosy was incurable but a case that came under my observation in 1926 made a great impression on me This was a young man with nodular leprosy I began treatment in the usual way with Choulmoogra oil and was astonished to note the gradual *disappearance of the nodules* and *the steady* improvement in his general health At the time of writing August, 1933, this patient is quite free from leprosy and a happy member of civilized society

The astonishing recovery seen in this case led me to take greater interest in lepers and in the present work I propose to give the results of my studies and researches in connection with the problem of leprosy I am pleased to say that this State is shortly to have a Leper Asylum for the free treatment of this disease

I hope this short account of the subject expressed in simple language will be useful not only to medical practitioners but also *to the general public and will help in the* great work of ultimately stamping out this dire scourge which has plagued the human race since the dawn of history

It will be convenient to study planning a campaign against leprosy under three heads —

1 The difficulties, or the problems
2 The requirements, or the theoretical solutions
3 The methods, or the actual ways and means

1 The Difficulties, or the Problems

The main difficulties which present themselves in India for instance, and this may be taken as typical of most countries where

leprosy is prevalent and presents a problem, are —

(a) Ignorance and fear on the part of the public, ignorance of the disease itself, and fear as to the possible consequences of their having contracted it This is perhaps the most important difficulty to be overcome

(b) Ignorance and prejudice of the Medical Profession regarding the early signs and symptoms of the disease, and modern methods of treatment Doctors have had little, if any, opportunity in the past of studying leprosy as students at college They have also a prejudice regarding the curative powers of present day methods of treatment

(c) Poverty of the people The great mass of the people of India for instance, are exceedingly poor and can therefore afford but little in the way of medical treatment It is also almost an impossibility for them to manage to go long distances for a treatment which extends over a period of many months and often

many years

(d) Lack of a sufficient number of Centres for treatment This naturally follows from (c) where the distances to be travelled are enormous in some cases /

(e) Inadequate knowledge of the number and distribution of the lepers requiring treatment as there are cases which can only be detected by a doctor, whereas experience has proved that in the various Census taken in India, only such cases which could be detected by unskilled workers were enumerated, and these were the most advanced cases—obvious to anyone

Muir (Muir, E P T S Centres Vol II F E A T M Dec 1917, p 377) in carrying out a survey in a district in India where leprosy was highly epidemic has shown how the census figures are far below the actual number of lepers. He says — "The Survey showed about four times as many lepers as the unskilled census had shown"

2 The Requirements or the Theoretical Solutions

These may be considered under the following heads —

A 1 Education of the public

2 Education of the Medical Profession

B Organised investigation as to the extent of the disease in affected areas, and provision of ample facilities for free treatment

A. 1 Education of the Public

Until comparatively recent times leprosy was not considered a disease worthy of co ordinated scientific investigation, but with the advancement of our knowledge, as has been already noticed, old ideas of it are fast losing ground Now, in any scheme for combating leprosy it is essential that the public should be educated to an intelligent understanding of the disease The question is, what should they be taught

(a) First and foremost we must make it known that leprosy is no longer incurable If diagnosed in the early stages and treated efficiently the *disease can be cured* Even when the disease has been present for sometime, considerable improvement and in many instances, a cure is possible This knowledge would not

only remove the ignorance so prevalent with regard to the disease, it would also go a long way to eradicating the feeling of shame and fear which have hitherto proved strong deterrents in the way of securing early presentation for treatment

(b) It must be impressed upon the public that it is not always those who are obviously leprous that are the greatest danger to the community In many of these the disease may have run its course, leaving them mutilated but not infectious These are commonly termed burnt out cases The greatest risk of contagion is found in the early and middle stage cases in whom the non medical eye could detect little or no evidence of the disease

(c) People generally, as well as the victims themselves should know that as regards infection the disease is of two types—Infectious and Non infectious.

1 The knowledge of this fact

might hinder people from concealing possibly infectious lepers in their houses These lepers living in close contact with other members of their family might thus become foci of infection On the other hand it might prevent relatives from casting out *one who showed signs of the disease* and who, on investigation might be found to be suffering from the non-*infectious type* At any rate, their inquiries would lead to early diagnosis and consequent early *treatment*

2 The knowledge might also weigh with employers (Donaldson, R. S Some Observations on the Employment of Lepers during and after Treatment Leprosy Review, October 1930) who, on the appearance of any sign of leprosy in an employee are inclined to dispense with his services The fact that the type may be non infectious might make him pause and investigate before taking drastic measures It can be readily understood that a man unemployable,

ill fed, and suffering from a disease which makes him practically an outcast from society gradually sinks until he joins the beggar class, and in all probability becomes an infectious case and a danger to others

(d) Side by side with the promulgation of these pertinent truths there must be a vigorous enforcement of the elemental laws of cleanliness and sanitation It cannot be sufficiently emphasised that the conditions which induce disease of any kind are favourable to the development of leprosy and only as these conditions are improved can real progress be made in the campaign for its eradication There can be no doubt also that leprosy is a disease which flourishes in a diseased atmosphere My experience has been that the removal of other diseases such as syphilis, hookworm and malaria go a long way to ridding the patient of leprosy

(e) For the sake of the children of lepers it would be well to impress

on the public the fact that leprosy is not hereditary and that by the *early removal of children from* infectious lepers the probabilities of the former developing the disease are remote

A 2 Education of the Medical Profession

It is perhaps not surprising how little the ordinary practitioner in tropical and sub tropical lands knows regarding leprosy As a *medical student he has not been trained to* diagnose and treat the disease because the forward movement towards the solution of the leper problem is so recent They must now be taught, however that leprosy is remediable and they must be trained to recognise the early signs and symptoms of the disease They must learn the latest methods of treatment They must be taught, just *as much as the public* the various points I have discussed under A 1

There is little use carrying on extensive propaganda if we have not a sufficient number of doctors capable of making a diagnosis and giving efficient treatment

B Organised Investigation as to the

Extent of the Disease in affected Areas and Provision of ample Facilities for free Treatment

In instituting a campaign against an enemy the most important thing is to know the numbers and to study the habits of the enemy We require a census of the lepers This is not so easily done as might be thought, because it takes skilled observation beyond that possessed by an ordinary census officer to recognise an early case of leprosy Where skilled observers are employed to enumerate the number of lepers in a locality the figures as I have already indicated, are from four to six times more than those shown by the ordinary census Our views regarding the measures to be directed against leprosy have had to be changed radically in the last few months as a result of increased knowledge of the nature of the disease Formerly we had little plan in our methods except an attempted and incomplete isolation of easily recognised lepers Now survey parties are required These must consist of trained leprosy officers and their duty is to detect and enumerate the lepers These Officers while carrying out their investigations can

do much in the way of propaganda among people and also establish treatment clinics in the various localities Such a system is the basis of Muir s method of dealing with leprosy in India under the title of "Propaganda, Treatment—Survey Centres" (Muir E P T S Centres Vol II F E A T M Dec 1917) I *shall discuss this subject under "The Methods."*

There is no doubt of the fact that a greatly increased number of small treatment centres or clinics are necessary because we can never hope to have all lepers in institutions The majority of the people in India, China, and Africa, live in villages and are exceedingly poor The cities contain many lepers but on inquiry one finds that few of them actually belong to the cities in which they are found This being so, what tremendous numbers must be scattered over all tropical countries and of what avail is the present number of centres where treatment can be obtained Admission is refused through lack of accommodation If we could take the treatment of the patients in a greater degree, what a blessing it would be for the sufferers, and how many, by getting early treatment, would never go on to the advanced stages

of the disease Not only however, must we provide more places for treatment, but the treatment must be free for the poverty stricken masses of these tropical and sub-tropical lands

3 The Methods or the Actual Ways and Means

Work for lepers in India has in the past been largely conditioned by two outstanding factors The first that it has predominately been undertaken by Christian men and women, inspired with an ideal to minister not only to the physical, but also to the Spiritual The second that the disease made no substantial response to remedial treatment and that therefore service was directed to making provision for the care until death of those most seriously attacked and most utterly in need of sympathetic care

The first factor is not a startling one History has again and again repeated itself in showing that in the most healthy periods of the Christian Church it has taken a lead in ministering to the physical as well as to the spiritual needs of the people, and in awakening the social conscience of the community to a sense of its duty

The second factor, the incurability of the disease, largely governed the form which the service of lepers took, and so asylums where the most advanced cases could find refuge were gradually established in various parts of India Moreover, the incurability of the disease, together with the fact that it is contagious in certain stages and very horrible in its worst effects, resulted in occasional agitation for compulsory segregation An imperfect knowledge of the disease led to the false impression that the case with the most sores was the case that was the greatest menace to the public, and consequently emphasis was laid upon the necessity for the compulsory segregation of beggar lepers in whom the disease was conspicuous because of its terrible ravages

Acts were passed First, the beggars with open sores were to be segregated and then, though this first Act (*Act III of 1898*) failed to be carried out effectively almost everywhere, another was passed for the segregation of all beggar lepers subject to the adoption of the Act (Act XXII of 1920) by Local Governments The difficulties of application of these Acts became apparent

when committees got to work on details The human factor began to be recognised, it was seen that the normal policeman is not keen to arrest beggar lepers, it was seen that the beggar leper is not keen to be arrested and interned, and above all costs loomed ominous And so these Acts have had little effect upon the quantity of work done in India for lepers

The basis of voluntary segregation has been the one upon which the grater part of leper work has been maintained, although that voluntary segregation has only come when the disease was well advanced But the two factors that have so largely conditioned work among lepers hitherto are beginning to be modified The work done by missionaries and those who have made their work possible is bearing fruit in a wider sense of responsibility among the more enlightened sections of the general community And now science is coming to modify the other factor which had conditioned leper work, namely the incurability of the disease

New developments must bear in mind the consequences that will gradually become apparent from a better and more widely

available treatment Much has already been done at many leper asylums to face a difficult and changing situation The advanced case will not be so common twenty years hence as it is to day, and future policy must bear this in mind Adaptation rather than extension may be the next stage of development

Treatment is going to mean that earlier cases *will* more and more seek the help of an institution, not as a last refuge but as an avenue to health That means a reconsideration of the medical organisation of asylums and hospitals and the training of staffs who shall be real specialists Because of the great importance of the development of and the need for efficient central leper institutions where treatment, research and training can go on I shall discuss such central institutions at length in another section

At present leprosy work is tending to be organised on the basis of the out patient clinic where patients attend voluntarily for treatment and are supposed, if necessary to practice segregation in their own homes This question of out patient departments and of separate dispensaries must be considered not simply academically but with a view to

seeing how far the personnel of asylums can be usefully employed in this growing branch of leper work

Muir in 1927, at the Seventh Congress of the Far Eastern Association of Tropical Medicine (Muir E P T S Centres Vol II F E A T M Dec 1917) advocated what he termed the propaganda—Treatment—survey centre as a means of dealing with leprosy and although he stated that it was not intended to decry leper institutions, such as hospitals, asylums and settlements which were useful and necessary yet he maintained that out patient clinics were to be the chief means of tackling leprosy problem in the future

No doubt a far greater number of lepers can be brought under control by out patient clinics, and a far greater number of earlier cases treated and these are advantages, but in a country like India for example, there are great disadvantages with such measures. Among these disadvantages the following are outstanding—

1 A number of small out patient clinics widely separated are exceedingly difficult to organise and run efficiently

co ordination of such clinics is essential and this is often very difficult.

2 Many patients time after time require special treatment in the intervals between their attendance at the clinic and cannot obtain it.

3 The segregation of infective cases in their own homes even when possible, is rarely carried out

I maintain therefore that a central institution is absolutely essential to the success of any leper campaign and not a chain of isolated out patient departments with no controlling institution possessing an adequate staff and an up to date laboratory and equipment It is well to emphasise here again however, that each country has to approach the leprosy problem from its own angle and a method in one country may not be possible in another For instance in the more sparsely populated mountainous tracts of India or in countries like Africa where there is not a sufficient supply of trained doctors it is quite obvious that the out patient clinic alone is not applicable In such places it will certainly be necessary to gather the patients together into Treatment Centres or

Central Institutions where they could cultivate the land or otherwise support themselves, special arrangements being made to feed those not able to work for their living and where they would receive the latest treatment for the disease from qualified men and women, or from nurses under medical supervision

In present day leper work there is great danger of concentrating on one scheme and forgetting that it is only by a combination of schemes that the attack can be properly pursued

Leprosy died out of England about 300 years ago and India now is somewhere in the position of England about 400 years ago This therefore is the psychological moment for dealing with the question India is peculiarly well suited for extensive anti leprosy measures for in the first place the British Empire Leprosy Relief Association is endeavouring to acquire treatment centres for the early cases of leprosy and in addition there are leper homes and hospitals throughout India which are dealing to a large extent with the problem of the indoor treatment of leprosy It is the proper balance of out patient clinics with adequate

provision of central institutions and hospitals, combined with intelligent research and propaganda which will ultimately bring this scourge under control



CHAPTER II

Historical outline

Ancient History Descriptions of leprosy have been found in some of the oldest records, and the origin of the disease is lost in the mists of antiquity According to Munro, the earliest account is to be found in an Egyptian record of 1350 B C in the reign of Rameses II among negro slaves from the Soudan and Dafur to the South of Egypt, and, although this reading has been disputed, the disease is certainly of ancient origin In India it is mentioned as in the Vedas of 1400 B C while it appears not to have existed in China in 1500 B C but has been known there since the first or second century B C when it affected the south-eastern coast regions, which were in early communication with India, whence it was probably introduced by sea. As the disease was certainly introduced from Africa into Europe and America within historical times, and Northern belt of Central Africa from Nigeria to Abyssinia is still the most severely affected portion of the globe, it seems probable that leprosy originated in that area.

The Spread of Leprosy over Europe

According to Munro, Hippocrates, writing about 400 B C did not describe leprosy, but Aristotle did so about 345 B C so it was then present in Asia Minor on the Greek coast as a still rare disease, and it probably became common about 200 B C Up to the conquest of Egypt by Cambyses in 525 B C that country was closed to the Greeks and soon after became the conquest of Darius, and then in 480 B C that of Xerxes, who according to Herodolus, led six million people into Europe from all the nations of Asia and Africa under his rule, and left thousands behind him when he retired, which would account for the introduction of leprosy into Greece, with a slow spread at first, gradually increasing

The further progress in Europe can be traced as leprosy was unknown in Italy until the return of Pompey's soldiers from the east in 62 B C while Galen wrote of the disease in Germany in A D 180, and four centuries later it had become so common and widespread that according to Virchow, there were then 36 leper houses in Italy, Verdun and Maestricht In the fifth and

sixth centuries, Spain was infected by Roman troops, and it was common there by the tenth century after the fall of Rome the conquests of Alaric and others further disseminated the disease Two centuries later it was common in France having been introduced in the seventh century into the Pyrenees, whence it spread north

The spread in the western hemisphere is due to European discoveries and immigrants, and also to African slave trade

The extensive spread of leprosy by chinese immigrants has been pointed out by Cauthe (1897) and by Jeanselme (1902) who record that they "carried the disease to Indo-China, Siam, Straits Settlements, Java Sumatra, Borneo, the Philippines and other East Indian islands, in several of which countries Chinese still form by far the majority of the infected

Thus the whole history of the spread of leprosy is one long record of affected persons carrying it to countries previously free, where as a rule it increases very slowly and insidiously at first, taking from one to several decades before it attracts while the only countries from which it has disappeared as an indigenous disease after being

firmly established have been *temperate zone* areas of Europe in which severe repressive measures were enforced, aided by great advances in food, sanitation, and general civilization

Leprosy is a communicable disease the spread of which is favoured by insanitary conditions, *especially in a hot, humid climate* defective and over crowded houses, promiscuity general and sexual, social customs such as sleeping, eating, and smoking together, the absence of all fear of lepers leading to the neglect of precautions against coming into close contact with infected persons, and the *absence or abandonment of all prophylactic* measures against the disease, probably aided in some cases by a diet deficient in fresh vitamin containing elements while the contrary conditions are unfavourable to the prevalence of leprosy

The nearly universal ancient belief in *the infectiousness* of leprosy is so well known as not to require detailed consideration and is *well illustrated by the severe measures* taken against the spread of the disease both in the time of Moses and during its prevalence in Europe in the Middle Ages, and

those adopted by various savage races The unreasoning dread of leprosy is not extinct even in the most educated races of the world, such as a leper being brought into court in the United States of America, when most of those present including the judicial ermine, fled from the room and of the *people of an English country village agitating* against the presence of a leper in a nursing home with ample private grounds under perfect sanitation, although it is well established that leprosy does not spread in temperate climates under favourable hygienic conditions

Segregation is simple in theory but difficult in practice In the case of a highly contagious and dangerous disease with a combined incubation period and course of only a very few weeks, such as small pox, it is comparatively simple to convince the average reasonable member of an educated community of the necessity for absolute and immediate isolation of every case as soon as discovered, so that the co operation of the general public can be counted on in carrying out this essential measure It is very difficult in the case of leprosy with an incubation

period of from a few months to many years, the average period being several years, a frequently slow and insidious onset, especially in nerve cases, the early diagnosis of which even by a medical man requires considerable experience of the disease, a duration in the more rapid nodular cases averaging eight to *ten years and in the milder anæsthetic cases* nearer twenty years, necessitating life long incarceration of persons whose general health is generally for a considerable time but little affected, and who hitherto have had little or no hope of amelioration of their sad condition, which tends to become progressively more piteous The disease is probably but little, if at all, more infective than tuberculosis, though the serious facial *disfigurement in the nodular form,* and the crippling loss of fingers and toes in the little infective nerve variety, ultimately make *the sufferers so repulsive,* that in all historical ages, and in many parts of the world, compulsion has been used to destroy or *isolate them, but only when they have already* infected others while in the earlier stages of the disease The fullest possible benefit from the *drastic measures enforced* has thus

not been obtained, so it is not surprising that such prophylactic measures have only too frequently failed to stamp out, or even greatly reduce the incidence of the disease

In India the number of lepers precludes the possibility of general compulsory segregation on the ground of expense, even if it were otherwise feasible, which is very doubtful, but much has already been accomplished in the establishment of large numbers of leper asylums throughout the country, which the census figures indicate may have played some part in the slight decrease of leprosy shown by the returns, as suggested in the India Census Report of 1911, for in the decade ending with that year the number of leper asylums had greatly increased up to seventy three with some 5000 inmates while by 1921 the numbers were 8 890 and the proportion had risen to 7 7% more than half of whom were in the Mission to Lepers' Asylums, the average number in each asylum was thus 94 which is far too small to allow of adequate administrative and medical staff for each on economical lines

At an important All-India Leper Conference in Calcutta in 1920, Sir Rogers advo-

cated large leper colonies in the country away from towns, with ample ground *for* cultivation, and sufficient medical staff to allow of the inmates being given full advantage of the recent progress in treatment, a policy which has since been adopted by the most important provinces of India, although financial stringency is retarding its being carried out Private enterprise has done much good work for the lepers of India, such for instance, as that of H A Ackworth, who, when Municipal Commissioner of Bombay, collected *funds for the Matunga Asylum of that city*, and interned many of the repulsive begging lepers under an old Act in 1890 while a similar humane work was carried out in the founding in 1840 of the Almora Leper Asylum, situated in one of the worst infected areas In India by Sir Henry Ramsay

Leprosy Relief work in India—1932

For another year in succession the activities have suffered from financial depression, and the pace of progress has not been as rapid as was desired The problem of leprosy cotinues to present the same diffi culties as before although enquiries and research are steadily re-*inforcing* the *me-*

thods for dealing with it, and the exact number of leprous patients still remains an unknown quantity This melancholy view is expressed in the annual report for 1932 of the Indian Council of the British Empire Leprosy Relief Association

Unabated efforts in surveys and the operations of the propaganda—Treatment Survey Centres are enabling a more accurate computation to be made The early cases in the proper teatment of which alone lies the greatest chance of reducing the incidence of the disease and its ultimate eradication, are still shy of the doctor But with the steadily increasing number of clinics which are being established in the provinces and states, the dissemination of knowledge with regard to the prevention and treatment of the disease, and the encouraging results of the treatment given at these clinics, ever-increasing numbers of leprous patients are daily coming within the pale of the latest methods of diagnosis and treatment.

The policy of forcible segregation as the best means of dealing with the problem of leprosy amongst large segregation of population no longer holds the field, as the

most recent research has relegated it to a position of secondary importance in comparison with that of diagnosis and the treatment of patients in the early stages The value of isolation, however, both from the social and medical points of view, is very great and the association does not wish to deprecate in any way any move made in the direction of the establishment of colonies etc for lepers Some of these colonies have in recent years made arrangements for treatment also

The policy of the Association owes its inception to the recognition of the fact that in the detection and treatment of early cases, accompanied by special propaganda, lies the only hope of gradually reducing the incidence of the disease and so exerting an efficient control The measure of success in this direction will be the measure of advance towards a realization of the ultimate object of the Association i e to rid the country of leprosy

The cause of the disease is bound up in wide superstition It will take years for modern methods of propaganda and treatment to kill such prejudice as the villager in India has for centuries learnt to associate

with this disease, which has only been seen to cause suffering and death An arduous and prolonged education campaign must therefore precede the stage of enlightenment Diverse social conditions present another difficulty in the way of both investigation and treatment. As the difficulty of examining purdah women is almost insuperable at the present moment, the Association looks forward to the day when trained medical women will be available for this work

CHAPTER III

Etiology and pathogenesis

It is not quite certain how leprosy is aquired or transmitted from the patient to the healthy individual, although it is generally believed that leprosy is communicable and that in some manner the bacilli pass from the sick to the well and that in at least a small proportion of such instances the disease is reproduced

The influence of climate upon the spread of leprosy is not clear While leprosy is generally classified as a tropical disease and more commonly occurs in tropical countries, this is probably largely due to the state of civilization which prevail in such countries The disease, as is well known, was formerly very common in Europe and is still common in Iceland, which would appear to demonstrate that climate is not alone at least a determining factor in its distribution and spread The disease has its onset particularly in youth and early adult life—cases are rare in very young children, and the disease is also uncommon after seventy years, in fact, the majority of the cases occur between

the tenth and the thirty-fifth year The number of males attacked with leprosy is almost double that of the females, but apparently there is no satisfactory explanation of this fact During the course of the disease the fertility of the female does not appear to be impaired, but the fertility of the male is materially reduced often by the existence of leprous orchitis

Stricker advanced the idea that the initial lesion of leprosy was to be found in the nasal mucous membrane and in ulcerations of the nasal septum, and that it was by the atrium of the nasal mucous membrane that infection occurred Nasal lesions are certainly common and early in leprosy, and the Bacillus Leprae is often found in the nasal mucous membrane and in the discharges from the nose, so often that bacteriological examination of these discharges is a valuable aid in diagnosis This thus represents one channel of infection Many observers believe that the common mode of infection is, in all probability, through accidental abrasions or other lesions of the skin, but on the other hand a number of attempts to infect healthy persons by experimentally

inoculating them with fresh lepra Bacilli containing material have completely failed, with the doubtful exception of Arning's case of a convict in Hawaii, who may have contracted his subsequently developing disease from two near leper relatives This negative evidence however, loses much of its value on account of all the *experiments having* been carried out on adults who had passed the most susceptible age period, none of the ten persons inoculated by Profeta was under 25 while most of them were from 31 to 47 years of age, when the majority of persons are probably insusceptible to the disease

In those afflicted with the disease the leprosy bacillus is generally present in the *granulomatous lesions in very large numbers,* in the lymph spaces as well as within cells called "lepra cells," and in endothelial and connective tissue cells The organism may be found in almost any part of the body in different cases with the exception of muscles, bones, cartilages and intestinal tract It is very abundant in fluid expressed from the nodular *leprous* lesions, in the ulcerations of skin, and is *often found in the sputum* as well as in the nasal mucus It is usually not found in

anæsthetic areas of the skin In such cases the bacilli are located in the nerves which supply those areas lying between the fibres and within the nerve cells The Bacillus is also found in the enlarged lymphatic glands In the internal organs it is particularly prevalent in the liver and pleen, lying both free and within the cells The organism has also been found in the circulating blood particularly during the febrile periods

Hence it is evident that large numbers of leprosy bacilli are continually being given off from the leper patient, particularly through the secretions and open lesions and in fact these bacilli are often found in the immediate surroundings of lepers However, it is questionable whether many of these organisms are alive or at any rate sufficiently virulent to infect the healthy individual While the percentage of attendants and physicians administering to lepers who become infected is small, nevertheless such infections do occasionally occur The very long incubation period of the disease, which it is believed, may vary between one and ten years obviously renders more difficult the detection of the method of infection in any given ca e.

The Hereditary Theory of Transmission of the Disease

It was regarded as the most important factor during the nineteenth century in Europe The hereditary factor, in addition to contagion, has also been believed in certain countries for centuries, especially in China and Japan as well as in some parts of Africa such as North Nigeria, but it is very significant that in such countries it is admitted that the hereditary taint does not usually make its appearance until the age of puberty, and the disease is never congenital

In China the hereditary influence is believed not to extend beyond the fourth generation, up to which the descendants of leper are not permitted to marry into families free from the disease, and only with those of leprosy infected families of the same degree of remoteness from the leper ancestor as themselves

Hansen recorded having found 51 of 210 lepers or under one fourth, had leper relatives in the direct line of descent in spite of frequent intermarriages in small isolated communities, and he pointed out that even in Norway it is perhaps remarkable that

where the appearace of leprosy may be considered as of relatively recent date, there is very seldom any relationship between the lepers, nor do the latter descend from leper families of other places Holmsen has also recorded very instructive Norwegian figures regarding 93 lepers only 12 or 13 per cent, of whom had parents or grand-parents who suffered from the disease, while in no less than 11 of the 12 parents or grand-parents were attacked after the birth of their children, so that in only one of the 93 was any evidence of possible heredity found

In spite of the fact that leprosy bacilli have sometimes been found in the placenta, foetus, and milk of leprous women, we know that children of leprous parents are generally born healthy Zambaco states that he has seen congenital cases of leprosy, and Nakayo has reported a case in Japan of a new born infant with typical leprous infiltrations and bacilli These are very unusual exceptions Mccoy, while admitting that the children of leprous patients develop the disease much oftener than the children of healthy parents among the same population, points out that the children born in leper families are not likely

to develop the disease if removed at once from the leprous surroundings In a report of the Nasik Leper Asylum of 44 children which were removed to a home situated over two miles from the asylum, 34 later passed out uninfected, 8 later became married and their children are perfectly healthy, as are also 10 which remained at the home at the time of the report At the Ramchandrapuram Asylum, of 40 children born, only 3 contracted the disease, 2 of which had long lived with their leprous fathers before being admitted to the home It is therefore evident that there is not the same tendency for the children to contract the disease from their parents if they are separated from them shortly after birth

Hutchinson's Fish Theory As early as 1863 he declared leprosy to be "fish-eaters' gout,' and dependent on excessive consumption of badly preserved or decomposed fish, but in view of the facts brought forward to disprove that contention, and after the discovery of lepra bacillus, he greatly modified it and held that eating any bad or half cured fish on a single occasion might produce leprosy, developing many years later—

which was difficult to disprove in view of the world wide consumption of fish

This theory has received no important support in recent years nor has there been important evidence submitted which points to the acquiring of the disease through the alimentary tract Innutritious food and lack of suitable food, however, just as unhygienic and insanitary surroundings must be admitted as among the chief predisposing causes of leprosy

Numerous attempts have been made to inoculate man experimentally with leprosy by the sucutantors injection of leprous material or with supposed cultures of the leprosy organisms. These have all resulted negatively except in one doubtful case of a convict who was inoculated with an excised leprous nodule inserted under the skin and who developed lesions of the disease after three years The lesions in the case of this convict developed first at the site of the inoculation On the other hand Danielson inoculated himself and 9 others as did Profeta, with material from the lesions of nodular leprosy, but failed to produce the disease Accidental inoculations of physicians or atten-

dants upon lepers with leprous material in surgical instruments through cuts or abrasions of the skin have also generally resulted negatively However, Rogers has reported 2 cases of doctors who wounded their fingers while operating on leprous patients and both not long after developed leprosy commencing with anæsthesia in one, and red leprous patches in the other, in the very fingers they had wounded The susceptib lity of the individuals vary and many healthy persons are at least relatively immune to leprosy

Although the exact method of transmission of the disease is not known, most authorities agree that every case of leprosy owes its origin to contact direct or indirect with some other individual suffering with the disease, and by close association with lepers one would appear to be undoubtedly exposed to danger of infection By wearing the clothes used by the leper relatives, and by sleeping in the same bed under the same cover, as is seen in these hills, the disease rapidly passes from one to the other There is a family which illustrates this very clearly The great grand father developed leprosy, then grandfather then father, and at present two of five children

are suffering from nodular leprosy It is a remarkable fact that even when contact would appear to give the most favourable opportu nity for infection between the diseased and healthy as often occurs in leper colonies, and in families in these hills, the disease is not transmitted to cent per cent cases, and even between infected husbands and wives not over 5% of adults contract the disease

There is a firm conviction in the minds of many observers that leprosy i spread by sexual intercourse but this is not the only method of spread Jeanselme found leprous urethritis and numerous bacilli in pus from meatus, and believes that the disease may be unboubtedy transmitted by sexual intercourse

Leprosy may be transmitteh by flies bed-bugs, ticks, lice itch mites or chiggers Particularly during the febrile periods of leprosy the B leprae may circulate in consi derable numbers in the blood, and any bloo sucking insect might ingest this organisr These may be responsible for certain numb of cases but there is no conclusive evider that mosquitoes and other insects bear clear relation to the transmission of the case

of the eye, the mucous membranes of the mouth, larynx and pharynx *may be the seat* of similar nodular growths The change in all situations is a sort of chronic inflammatory condition attended by abundant formation of granulation tissue, nodular or diffuse in its arrangement In this tissue a large proportion, of the cells are of rounded or oval shape *like hyaline leucocytes*, a number of these may be of comparatively large size, and may show vacuolation of their protoplasm and a vesicular rope of protoplasm These are known as "lepra cells"

Among the cellular elements there is a varying amount of stroma, which in the earlier lesions is scanty and delicate but in the older lesions may be very dense Peri-arteritis is a common change and very frequently the superficial nerves become involved in the nodules and undergo atrophy Unlike tubercular lesions, the leprous nodules never undergo caseation

In the anæsthetic form, there is diffuse infiltration of the nerves, leading to the destructions of nerve fibres In the earlier stages which the chief symptoms are pains along nerves, there occur patches on the skin,

often of considerable size, the margins of which show a some-what livid congestion Later these patches become pale in the central parts and the periphery becomes pigmented. Then later skin becomes atrophied, parchment-like and anæsthetic and the bones also become atrophied owing to irregular affection of muscles These lesions are the result of chronic inflammatory process of the nerves; but the granulation tissue is less in amount, and has a greater tendency to undergo cicatricial contraction The bacilli are present in fewer number than in the nodular form of leprosy

CHAPTER IV

Clinical Appearances, Diagnosis and prognosis

Clinical Appearances

Prodromal Stage This extends to several years

The onset is slow and insidious, and is characterized by febrile attacks from time to time (Leprotic fever) with profuse sweatings, *malaise headache, and pains* in the back. There is also a tendency to be drowsy and falling off to sleep at unusual times The nose gets dry or blocked and epistaxis is common —the pulse rate is high in the morning

Sooner or later after some years with one of the attacks of fever, characteristic *leprous eruptions* appear, and *then the* case *tends to assume* one or other of the varieties along with other characteristic symptons of leprosy, depending on the site of the Bacillus

Clinically we recognise three forms of the disease —

1 *Tubercular Leprosy*
2 Anæsthetic Leprosy
3 Mixed Form

Tubercular Leprosy

After prodromal stage the patient has more frequent attacks of fever than usual, and during one of these, characteristic rash appears It first shows on the face, lobes of ears and extremities, less frequently on the trunk The rash is macular and shows as irregular slightly raised maculae of coppery or reddish colour These fade away with the disappearance of fever, but leave behind at their sites, hardening and pigmentation of skin

Sooner or later with successive attacks of fever leprous deposit occurs at the site of maculae i e forehead, eyelids, nose, lips, cheeks, ears and extensor surfaces of limbs and charcteristic nodules begin to appear These show as tense, shiny, reddish brown or dark elevations in the skin, from the size of a pea to that of walnut or larger

In the course of time, other parts of the skin also get affected, and so also the mucous membranes such as conjunctiva nasal mucous membrane, mucous membrane of mouth, throat larynx etc The nutrition of the patient also suffers—he becomes weak and emaciated, hair drops off in patches, and nails may flake off. The development of

nodules changes the appearance of the patient, and gives him 'leoine' appearance (*Leontiasis*) The skin of forehead thickens, eyebrows become prominent, nose broadened, lips thicker, cheeks pendulous, chin swollen ears enlarged and skin of the body generally becomes thick and lumpy The nodules in the conjunctiva may interfere with vision, those in the nose may block it, those in the larynx may cause alteration in voice The blood shows leucocytosis and may show bacilli, urine shows albumin

Finally the nodules inflame and necros, leaving behind ulcers, which tend to spread *both superficially and deeply, eating away* all the subjacent tissues They may heal by cicatrisation and leave dreadful deformities. The nasal septum gives *way and the nose* becomes broadened like that in syphilis The eyeballs may be disorganised and the patient becomes blind Mouth may get deformed and swallowing becomes difficult Fingers and toes may also ulcerate and fall off. Finally the patient dies of renal disease, tuberculosis *or other concurrent* disease The average duration of life of ordinary case is—4—8 years, but I have seen cases living up to 14—

15 years There is a case under my treatment with nodules all over both skin and mucous membranes He is leading active life doing all the home work It is 14 years since he developed the disease and I think he will live for a couple of years more, even without treatment.

Anæsthetic Leprosy

This is much more common here than the nodular form The earliest symptoms after prodromal stage, are those of irritation with one of leprotic fever, in the way of shooting pains along the course of the nerve or parasthesia like crawling, creeping tingling or burning sensation in the area of the distribution of nerve, or numbness usually of hands and feet, localised flushings or sweatings and the patient weakens mostly in hands and feet

In time leprous patches 1" or 2" in diameter, appear on the back of the patient, and on extensor surfaces of limbs They are slightly raised, pigmented and at first hyperæsthetic Fresh patches may continue to come out with febrile attacks, for one, two or more years.

Later on the patches increase in size and are serpiginous in outline They become depigmented, pale or white in the centre, margins remaining dark and raised, and become anæsthetic At the same time paralytic features develop *in nerve distribution* areas, with wasting of muscles, loss of reflexes and deformities specially curling up of the fingers and toes (clawed) wrist drop, foot drop, talipes etc

The superficial nerve trunks like ulnar becomes thickened and can be felt Finally febrile attacks occur with general enlargement of lymph glands, intensification of nerve symptoms, bullous eruptions on various parts of the body The bullae rupture, and form scabs which drop off, leaving pale anæsthetic patches *or ulcers These ulcers may become* perforating, and specially occur over the ball of the great toe heel, side of the foot or hands The perforating ulcers tend to eat deeply and may cause necrosis of bone, mutilation of nose and ears, and spontaneous amputation of fingers and toes may occur

General health fails Temporary improvement may occur from time to time, but the di ease remains progressing *till the patient* dies in 10-20 or 30 years.

Mixed Leprosy

In this form both nodules and anæsthetic patches are seen The progress of this form is more rapid, and the patient dies in 6–10 years I have not seen many cases of mixed form of leprosy I saw one case recently with complete amputation of toes of both the feet, and the face showing characteristic nodules But they do not both show the same intensity The more the skin is affected, the less the nerves and vice versa

Nerve lesions are associated with diminished number of Lepra Bacilli, so the earlier lesions are chiefly of the nerve type as there are few bacilli at the onset, and as the number once again diminishes towards the end of the disease nerve lesions again tend to preponderate.

There is no explanation of such an occurrence Syphilis whose lesions are so much like leprosy manifests nerve symptoms only when the virus has reached a comparatively attenuated form

A suggestion has been made that there is a different organism in nerve and skin leprosy, but the fact that the one type of leprosy after continuing for many years may

become changed into the other is against such a theory

Another suggestion is that nerve leprosy is due to non acid fast form of Hansen's bacillus which has a special affinity for nerves Such a theory would account for the super ficial lesions with radial advance in which there is anæsthesia but in which bacilli cannot be found on careful bacteriological examination

The parts of the body most exposed to atmosphere, such as hands and face, are the ones affected by leprosy at an early stage

The nerves chiefly affected are the great auricular nerve, the ulnar, the Radial These nerves are felt to be thickened The superficial peroneal nerve is affected in the same way, with resulting paralysis and anaesthesia Facial and supraorbital nerves also become involved Thus supraorbital paralysis and facial paralysis are not uncommon in leprosy In a case of generalised leprosy, all the nerves outside the central nervous system may be affected

The sclap is never affected, but palms of hands may show nodules in some cases.

Parts Affected		
Head & Neck	Upper Extre mities	
Face, nose, checks eye brows forehead Conjunctiva, cornea sclera, uveal tract setting up iri docyclitis, lips, nasal cavity tongue palate & fauces, phar ynx & larynx	Hands, upper arm & shoulder The fle xor sur faces are less affe-cted than the exten sor, el bow ul nar sur face of right hand Nails (thin ning & longitu dinal ridges) Blebs and blis ters are comm on on	The small in trinsic muscles of the hands, there is flatten ing of & hypo thenar eminen ces mus cles of the fore arm causing drop wri st Bon es of the fingers are also affected

Trunk and Internal Organs

Chest, abdomen, lungs, and spleen and liver, testicles, in late cases we have waxy degeneration of the bowels, liver and kidneys, causing diarrhœa or dysentery

Diagnosis

It does not require much skill or experience to diagnose an advanced case of leprosy, as the lesions are so charcteristic The aim should be to diagnose the case as early as possible, as the earlier the diagnosis, the easier the cure But early diagnosis is not easy, and it requires skill and special tests

There are, however, several difficulties which stand in the way of diagnosing early—as ignorance of the patient who thinks early lesion a trifling matter and not leprosy, ignorance of doctors, the fear of the patient that he might lose his job, the fear of the public

Although tuberculosis is far more easily transmitted than leprosy, yet the known sufferer from phthisis is allowed to mix with society whereas a leper is shunned

The two most important points in diagnosis are —

1 Anæsthesia.

2 The finding of lepra bacilli

1 There are various methods of testing anæsthsia. In testing superficial touch sensation, the patient is asked to close his eyes and expose the parts to be tested—they are then touched with a piece of paper and the patient asked if he feels anything and where

Sometimes the patient instead of pointing to the *exact spot that has been touched*, points to a part at a distance This shows paræsthesia By this method various areas of anaesthesia can be plotted out

If superficial sensation is absent in a case occurring in an endemic area the diagnosis will be one of the leprosy in 99% case (Muir) When anæsthesia occurs in patches it means ascending nerve infection when confined to toes or fingers it is due to infection of nerve trunks

2 Bacteriological examination Some recommend puncture of the thickened skin with a hypodermic needle and examining for bacilli The best *method is to clip a small section* from the skin with a sharp pair of scissors of moderate size curved on the flat The section should not be more than 3 mm in

length and 2 mm in depth Then the section is pressed, with the corium surface downwards, onto a slide that has been well cleaned, and a smear is made The lesion should be cleaned with spirit before taking the clip

The smear is then dried and stained with Ziehl-Neelsen's method Filter carbol fuchsin to the slide let it stay for 10 minutes to ½ hour, heating till steam appears, and allowing it to cool—wash and decolorise in 10 per cent solution of pure HCl or sulphuric acid in alcohol, for one or two minutes Wash and counterstain for two minutes in Methylene Blue Wash, dry and examine with $\frac{1}{12}$ oil-immersion lens The bacilli will be found stained red in clumps and singly

As the result of examination of 160 cases Lowe and Christian conclude that nasal examination showed the bacilli in only the number of cases that skin examination showed them, and nasal scraping was more efficient than smears Skin examination by either the split or clip method is far better than nasal examination, but most positive results were obtained by the clip method in the lobe of the ear, and only four cases

showed bacilli elsewhere and not in the ear lobe

Subrazes agrees that in pure nerve cases lepra bacilli are rarely found in the nose and he regards making sections for the bacilli of small nerve removed from an anaesthetic area as the best diagnostic procedure, nasal examination are reliable in nodular cases When there is nodular thickening of nerves they may be punctured with the needle of a syringe to enable the bacilli to be looked for

The Rubino Reaction in Leprosy

Sheep's blood corpuscles are obtained pure by repeated saline washing of defibrinated blood with the aid of the centrifuge and treated with 6% Formaldehyde brought to a hydrogen concentration of pH 7 4 with N/10 sodium hydroxide solution to preserve them, again washed in saline and the original volume of blood obtained by adding saline and then preserved in the ice chest Add 0 3 c c of sheep s corpuscles to 1 c c of the patient s serum in a small test tube shake and place in incubator at 37 c and note the degree of sedimentation at half hour intervals. Complete sedimentation in half an hour is a positive reaction

In the first stage only 50% cases were positive against 70 to 77 per cent in the second and third stages

This test is valuable for differentiating active from inactive cases as it is positive in the former and negative in the latter It can be of help for judging the efficiency of treatment

Differential Diagnosis

It has got to be distinguished from

(1) Syphilis—It is possible to distinguish syphilis from leprosy by the presence or absence of Anæsthesia in nerve lesions and of a positive bacteaiological examination in skin lesions Again sclap is rarely affected *in leprosy whereas it is affected in syphilis* The lobules of the ear are the common sites of leprous nodules but they remain unaffected in syphilis

Thickening of the nerves is another distinguishing mark in nerve leprosy

Wasserman s reaction is not of very great value, as it is positive in cases of leprosy with breaking *down of leprous granulation* tissue Further both diseases may occur in symbiosis

Kahn precipitation test can be used to distinguish leprosy from syphilis

Kolmer's method of carrying out the Wassermann test is more certain, as a positive reaction is never given by leprosy unless it is accompanied by syphilis

Other diseases with which it is confused are —

(1) Tinea—Many early cases of leprosy are mistaken for ringworm Pityriasis Versicolor often resembles depigmented patches found in leprosy but it is superficial with irregular margins and no anæsthesia

(2) Psoriasis—The absence of anæsthesia, *of bacilli and of depigmentation in the cenre* of the patch is again enough for diagnosis

(3) Tuberculosis—A leprous lesion of the lung may resemble tuberculosis of the lung Both diseases may occur together Bacteriological examination is helpful but the surest means is by inoculation in guinea pigs—when generalised tuberculosis results if the case is a pulmonary tuberculosis

(4) Lupus erythematosus

(5) Seborrhœa

(6) Erythema nodosum

(7) Syringomyelia

(8) Frambœsia

(9) Leucoderma—This is supposed here to be a form of leprosy The absence of anæsthesia, and the much more marked degree of depigmentation help to distinguish

Prognosis

It requires a careful consideration of various factors so as to be able to give prognosis in a case of leprosy These factors are —

(1) The stage of the disease In the first stage the prognosis is favourable and such cases are best suited for treatment They react well In the second stage the prognosis is not so good as the disease has spread over the body In the third stage when the immunity of the patient has reached a high level, the prognosis is more favourable The patient does not get fresh lesions, and the old lesions begin to clear up

(2) The removal of exciting and predisposing causes Where these can be removed, the prognosis is better

(3) The natural resistance of the patient is an important factor The greater the resistance, the less severe the lesions will be and slower the progress of the spread

of the lesions If by any disease the resistance is lowered, the disease spreads quickly, and renders the prognosis bad

(4) The individuality of the patient The successful treatment depends on the co-operation of the patient He should have sense enough to follow the direction and means to bear the expense

(5) Climate and sanitary surroundings. Dry, temperate climate is most favourable for leprosy Clean sanitary surroundings give more hope for recovery by enhancing patient's resistance and vitality

(6) The age of the patient The disease occurs most frequently during the 2nd and third decade The tendency to disease diminishes after the age of 30

If the patient is in the third stage, the doctor can safely say that infection will get less and less if othe factors are favourable.

In the 1st and 2nd stage the immunity has not reached a sufficiently high level so it is rather uncertain whether under treatment, the progress of the disease can be arrested, without passing through the 3rd stage

The germs can lie latent for 20 years or more and may again give rise to active

leprous lesions, in an apparently cured case Under the circumtances it is very difficult to say for certain if the patient is now completely free from disease

So the prognosis in the majority of cases is bad



CHAPTER V

Treatment

As in tuberculosis, the main emphasis in the treatment of leprosy should be laid upon the improvement of the general health of the patient It is doubtless true of all ailments that the physician should treat not the disease but the patient, for no two individuals react in exactly the same way to the same disease or the same treatment The past history of the patient s health his diet, habits of life and social condition must be carefully enquired into, and a thorough examination must be made for chronic accompanying dis ease All this is especially true of leprosy for it would seem from my experience in the treatment of the disease that the lower ing of the natural defensive forces of the body leads to spread of the disease The maintenance of the natural defences at a high level goes a long way to defeating any attack by the mycobacterium leprae

The treatment of leprosy then, b comes primarily the treatment of general depressing conditions such as errors of diet housing and exercise, the treatment of secondary infections

or accompanying diseases which tend to lower the defensive mechanism and the direct treatment of the disease and its sequelae

No drug so far as is known has a specific action on the mycobacterium but the remedies in use at the present day act by virtue of their ability to assist in strengthening the defensive powers of the body and so increase the general resistance of the patient The line of treatment which has proved most successful is also suitable or the purpose of eliminating leprotic lesions and causing the disappearance of the active signs of the disease especially in the early stages

The therapeutic routine may be dealt with under the following heads:—

(1) General management of the patients

(2) Special drugs and adjuncts to treatment used directly against leprosy

(3) Treatment of secondary lesions or sequelae

(4) Treatment of co-existing diseases, especially syphilis

1 The *general management* of the patients will be discussed later

2 Special drugs and adjuncts to treatment used *directly against leprosy*

(a) Substances used—these are as follows—for the general treatment of the di ease, hydnocarpus wightiana oil, Ethyl esters of hydnocarpus wightiana oil and alepol

(b) Historical note on the hydnocarpus group of drugs As Sir Rogers has stated in his 1929 Cameron prize lecture, the great advance in leprosy treatment during the past few years are due to our improved methods of administering the active preparations of chaulmoogra and hydrocarpus oils 'Chaulmoogra Oil he states is an old Indian remedy which was introduced to European medicine in 1854 by Mouart of the Madras Medical Service The drug was for long used orally but chiefly to its nauseating properties, it did not prove very successful, doing little more than retarding the progress of the disease In 1914 Heiser introduced treatment by the injection of the Mercado mixture which consisted of chaulmoogra oil and camphorated oil 60 c c of each, and 4 grammes of resorcin The injections were given intramuscularly and were very painful In 1916 Rogers renewed his efforts to obtain a soluble preparation of the active principles of chaulmoogra and hydnocarpus oils with

the result that Sodium Gynocardate was introduced for subcutaneous injections and proved an advance on the original oral method In the same year he used the preparations intravenously and obtained good results, much more rapid improvement taking place than when the drug was used subcut aneously One great drawback was the vein blocking which tended to occur after a period of injections After further work on the oils in question it was discovered that the active principle was the lower melting point fatty acid, and not the higher one as previously thought The lower melting point fatty acid of hydnocarpus oil namely hydrocarpic acid is very active, much more so than the chaulmoogric acid Morever, the Hydnocarpus Wightiana tree grows in great abundance on the west coast of S India, and it has been shown that its cultivation in other countries presents no great differences

In 1919 Hollmann and Dean in Honolulu reported success with the ethyl esters of chaulmoogra oil This preparation had also been in use by Muir in Calcutta, but later he chiefly carried out his treatment

with the ethyl esters of Hydnocarpus Wightiana oil In 1925 Muir introduced the subcutaneous injection of pure oil expressed cold from the fresh ripe seeds of the Hydnocarpus Wightiana fruit, and with 4% creosote added as an antiseptic From then onwards the use of the esters and the pure oil of Hydrocarpus began to be used extensively wherever leprosy was being treated. Rogers, however, continued his search for a drug which would not cause vein blocking in the same way as the sodium gynocardate had done, and the result was the introduction of Alepol—which is the sodium salt of the lower melting point fatty acids of Hydnocarpus Wightiana oil This was prepared by Dr T A Henry of Messers B W & Co Alepol has the added advantage that it can be used intramuscularly, subcutaneously or intravenously

(c) Preparations of drugs for geneal use

1 Hydnocarpus Wightiana oil The oil is obtained by cold expression from the ripe fresh seeds of the fruit of the tree After filtration 4% doubly distilled creosote is added and the mixture, after sterilisation at 120 C for half an hour is ready for use

ii Ethyl esters of Hydnocapus Wightiana oil The esters used may be prepared by the cold process or by the hot process All the cases under review in this thesis were treated with esters prepared by the cold process, and this only will be discribed The method is as follows —

Take 425 gms of pure cold drawn Hydnocarpus Wightiana oil, 552 c c of 96% ethyl alcohol and 31 87 c c. of pure sulphuric acid S G 1845

Method of mixing the above ingredients is as follows — Measure the oil into a receptacle, put the ethyl alcohol into another dish and slowly put the sulphuric acid drop by drop into the alcohol, stirring all the time Then add the alcohol acid mixture to the oil and stir thoroughly It is necessary to follow this order of mixing in order to prevent charring of the oil

Procedure

Pour the whole mixture into a large glass stoppered bottle and tie a piece of lint round the head Place the bottle in the sun When mixed and placed in the sun, the oil at first *forms* a lower and the

alcohol and acid an upper layer Later, as esterification proceeds the lower layer now chiefly esters—rises to the top, leaving the alcohol as the lower layer

Keep shaking the bottle daily each time it is put in the sun and when it is brought into the laboratory again in the evening So that the process of esterification may be complete, it is advisable to leave the bottle in the sun for half as long as the time taken for the esters to rise—e g if the lower layer took 20 days to ri e after the mixing of the ingredients then leave the bottle in the sun for another 10 days i e 30 days in all

Now pour the whole of the contents of the bottle into a separating funnel and draw off the lower layer of alcohol etc

Next wash the upper layers—the es ters—which is left in the funnel, with an equal volume of water Do this two or three, times drawing off the water each time. Then add an equal quantity of a 0 2% solution of sodium carbonate to form an emulsion Rotate thefunnel gently so as to mix the esters and carbonate solution completely Allow the emulsions to stand for a day

Then take one ounce of common salt and add two drams twice a day morning and evening—rotating the vessel gently each time so as to break up the emulsion On the morning of the third day remove the lower layer of salt and water—the upper layer of esters must now be drawn off and filtered through thick filter paper It is advisable to allow the esters thus filtered to stand in a glass stoppered bottle for another week until all the impurities have settled to the bottom Then filter again and the esters are ready for use They are now mixed with certain proportions of olive oil which will be given later and after the addition of 4% doubly distilled creosote and sterilisation at 120 C for half an hour they are ready for injection

Three strengths of the esters were used in the routine treatment, vis –

(1)	Ethyl esters of H W oil	50 c c
	Olive oil (fatty acid free)	50 c c.
	Creosote (doubly distilled)	4 c c.
(2)	Ethyl esters of H W oil	75 c c
	Olive oil (fatty acid free)	25 c c
	Creosote (doubly distilled)	4 c c.
(3)	Ethyl esters of H W oil	100 c c.
	Creosote (doubly distilled)	4 c c.

in Alepol This powder is a preparation containing the sodium salts of a selected fraction of the lower melting point fatty acids of Hydnocarpus Wightiana oil A 2% solution of the drug made up with a 0 5% solution of carbolic acid was used This was sterilised in the same way as the esters for half an hour at 120 C

(d) Dosage and administration

i Preliminary Statement From the time of opening the Lady Willingdon Leper Settlement to June 1927, the general treatment adopted there was the injection by subcutaneous infiltration of the pure Hydnocarpus Wightiana oil for skin and mixed cases, and the subcutaneous infiltration of the ethyl esters of the oil mixed with an equal quantity of olive oil for all nerve cases The reason for this division was that at that time it was considered that the esters were inclined to cause reactions which were thought dangerous to the patient It was also noted that reaction, at least those of a serious nature were more apt to occur in skin cases treated with esters than purely nerve cases It was also noted that the pure oil was milder in its

action and therefore more suitable for administration to skin cases As research, proceeded however, the writer noted two points with regard to the treatment with esters Firstly, serious reactions did not occur in any case which he treated with esters if the dosage was carefully controlled, taking note the patient s temperature and his general resistance

Secondly, mild reactions when produced and controlled were distinctly beneficial to the patient Rogers in discusssing the chemotherapy and mode of action of Chaulmoogrates and hydnocarpates regards the action of these preparations in causing a dissoution of the fatty coats of myco bacterium leprae and the setting free of antigens as indicating the advisibility of producing frequently repeated mild reactions Having arrived at these two conclusions therefore I abandoned the pure oil injections and adopted what I termed a standard course for the general routine treatment of leprosy About this time, April 1927, as has already been stated, Rogers introduced his Alepol and after a trial of the drug and chiefly because of its suitability for intravenous injection it was incor-

porated in the standard course and the results have fully justified its inclusion

ii Dosage—Hydnocarpus Wightiana oil Begin with 0 5 c c and increase at each injection by 0 5 c c until 10 c c are reached When 10 c c are reached treatment is continued by beginning now at 1 c c and increasing at each injection by 1 c c until 10 c c are reached This routine is continued until treatment is completed

Ethyl esters of Hydnocarpus Wightiana oil with equal parts of fatty acid free olive oil is given in the same dosage as the pure oil

The standard routine course is as follows —

Treatment is commenced with the first strength of the mixture The first dose is 1 c c and this is increased at each injection by 1 c c until 10 c c are reached This latter dose is repeated 5 times A start is now made with the 2nd strength of the mixture beginning with 1 c c and increasing at each injection by 1 c c until 10 c c are reached and repeating this dose for 10 injections Next the third strength of the drug is used again beginning 1 c c and

increasing at each injection by 1 c c until 10 c c are reached, repeating this latter dose on 10 successive injection days Treatment is then commenced with intravenous injections of Alepol, commencing with 0 5 c c and increasing at each injection by 0 5 c c until 10 c c are reached, the latter dose being repeated on 10 successive injection days The patient is then given a rest for one week having completed what is termed one period of treatment consisting of four courses At the end of the week's rest, treatment is begun again, this time beginning with 2nd strength of the ester mixture The commencing dose is 1 c c and this is increased at each injection by 1 c c until 10 c c are reached which latter dose is repeated as in the first period i e 10 times The third strength is now proceeded with in the same way and then the Alepol course is commenced once more, this time beginning with 1 c c and increasing at each injection by 1 c c until 10 c c are reached and repeating the, 10 c c ten times This then completes the 2nd period of treatment and another week s rest is given Should the patient require further treatment, the third

strength of the esters is given in the same dosage as in the last period, and then alepol also in the same dosage as in the last period, is continued until the patient is ready for discharge The attached table gives the scheme of the standard treatment as adopted in the settlement and found very efficacious. The gradation for children under 16 years of age is also given

Table (adults)

Period	Course	Drug	Dosage
1st	1	Esters 1	1 c.c. increasing at each injection by 1 c c until 10 c c are reached the latter being repeated 5 times
	2	Esters 2	Same as above only 10 c c are repeated ten times
	3	Esters 3	Ditto
	4	Alepol	0 5 c c increasing by 0 5 c c at each injection until 10 c c are reached the latter being repeated 5 times

one week's rest

Period	Course	Drug	Dosage
2nd	1	Esters 2	Same dosage as under first period.
	2	Esters 3	Ditto
	3	Alepol	1 0 c c increasing by 1 c c at each injection until 10 c c. are reached the latter being repeated for 10 injections.

one week s rest

Period	Course	Drug	Dosage
3rd	1	Esters 3	Same dosage as under first period
	2	Alepol	Same dosage as under 2nd period

one week s rest

Table (children)

Period	Course	Drug	Dosage
1st	1	Esters 1	1 c c to 10 c c increasing at each injection by 1 c.c.
	2	Esters 2	Ditto
	3	Esters 3	Ditto
	4	Alepol	0 5 c c to 5 c c increasing at each injection by 0 5 c c and repeating the 5 c c on 5 successive occasions

one week's rest

Period	Course	Drug	Dosage
2nd	1	Esters 2	As in the 1st period
	2	Esters 3	Ditto
	3	Alepol	As for adults in the 2nd period but only repeating the 10 c c five times
one week's rest			
3rd	1	Esters 2	As in the first period
	2	Alepol	As in the 2nd period
4th	Alepol to be continued to the end of the treatment period and consisting of courses with the same gradation of dosage as in the 3rd period of treatment with one week's rest between each		

iii Administration The pure Hydnocarpus oil and the esters are given by injection using the method of subcutaneous infiltration This infiltration may be given either under the lesions so as to produce their effect locally or they may be given into the outer sides of the thighs and so produce a general action Our method was to give half of each dose into the outer side of the thigh and the remainder under a lesion choosing a different lesion on each injection day All glass 10 c c syringes were used as they could be easily cleaned and sterilised Needles with a medium bore were used If the needles were too fine, injections became laborious, and if they were too large in the bore they caused too much pain To infiltrate an area the needle is inserted and pushed in as far as it will go A few drops of the drug are then injected and as the needle is gradually withdrawn the drug is gently pushed out of the syringe When the skin edge is reached without drawing the point of the needle, it is reinserted in a different direction and the same procedure gone *through* In this way the area becomes thoroughly infiltrated with the drug, and absorption tends to proceed

fairly rapidly Each time that the needle is pushed in up to the hilt and before injection of the material is commenced gentle suction in the piston is necessary to make sure that a small vein has not been entered This is particularly necessary with the pure oil and the first two strengths of the ester mixture which contains olive oil in order to avoid oil embolism

The Alepol is given intravenously To obviate vein blocking after a long course of intravenous injections we adopted the method devised by Muir in 1927 A 20 c c syringe is fitted with a needle having a fairly large bore The dose to be injected is then drawn into the syringe The vein selected for the injection is pierced and an amount of blood equal in quantity to the drug to be injected is drawn into the syringe which is held horizontally The drug and the blood are then mixed by loosening the needle gently from the nozzle of the syringe and rotating the barrel several times The needle is then tightened on the nozzle again and the mixture injected. Long period of Alepol intravenously can be given by this method without an appreciable amount of vein blocking It was

because of this blocking, however, which is more pronounced in some patients than others that I adopted the standard course which by its arrangement does not allow of sufficient endophlebitis occurring to cause blocking Another reason was that continuous injection by subcutaneous infiltration tended to become very painful and tissues became somewhat indurated The course of Alepol allowed of a return to normal and gave the patients a respite from the pain of infiltration

On injection days the bottles containing the various drugs for injection were placed in wide basins containing very hot water which was renewed as it became *cold. This* tended to make the preparations less viscid

It proved very useful during the cool season and is necessary in any country where the temperature is not sufficiently high to keep the drugs in a more or less fluid condition It is also much less painful than injecting the cold drugs As the Alepol formed bubbles on the surface, especially when the drug was being withdrawn, it was hung upside down from a special bracket and the drug drawn into the syringe by piercing the rubber cap with the needle

iv Frequency of injections Injections are given twice a week and the dose is increased progressively so long as there is no fever or evidence of general disturbance If the patient develops a temperature or complains of weakness or chest pain or in any way feels that he is not equal to the injection on any particular day the dose is modified accordingly, either giving him a complete rest or continuing with half his last dose for several injections Should the patient for any reason miss one injection, on resumption of treatment he receives his last dose Should he be absent for one fortnight especially if his absence has been due to fever it is better to begin him on half the dose he received at his last injection If he has been absent for more than a fortnight then it is wise to begin right at the beginning of his last course The temperature of each patient must be taken four times a day namely at 6 a m, 12 noon, 6 p m and 9 p m

(e) The Reaction in Leprosy and its Treatment The signs of reaction in leprosy are fever and headache, swelling up and redness of existing lesions and the appearance of fresh lesions together with nerve and joint pains Reaction under carefully controlled

treatment with Hydnocarpus Wightiana oil and its derivatives is not common, occurring chiefly in patients who have been poorly fed and whose general resistance is low It is very much more common and severe under treatment with pot iodide a note on which will be added later In fact the essence of treatment with Pot iodide, is the production of reactions If the reaction, no matter how produced, is severe and prolonged, it is definitely *harmful to the patient* I found the ideal method of treating leprosy is to keep the patient at reacting point Mild reactions lasting for 24 hours to 48 hours are in my experience beneficial

Any patient whose temperature was not showing signs of falling at the end of 48 hours or where the general signs of reaction did not tend to abate after that period, was promptly treated with intravenous injections of Pot antimony tartrate This drug in almost every instance brought down the temperature and caused subsidence of the lesions in a *short time* It is important however, not to allow the reaction to continue for longer than 48 hours *The drug* is obtainable in tablet form each tablet containing

0·04 gm This enables one to have a fresh solution at each injection Should the patient feel weak after the reaction it was my custom to stop all antileprotic treatment for some time and give a course of antimony, beginning with one tablet and increasing by half a tablet every 2nd day until two and a half tablets were reached. This was regarded as one course Should the patient not respond satisfactorily to this first course it is better to wait three or four days before commencing a second course. The following table shows the course and the proper amount of water in which each dose should be dissolved

P A T	Distilled Water
1 tablet = 0·04 Grm	2 c c.
1½ „ = 0 06 Grm	3 c c
2 tablets 0 08 Grm	4 c. c.
2½ „ 0 1 Grm	5 c c

If there is much nerve pain connected with reaction and this is chiefly so in purely nerve cases—the subcutaneous injection of 2 to 4 minims of 1 in 1000 adrenaline in 30 minims of normal saline usually proved exceedingly effective in dispelling the pain, we also found that ephedrine sulphate in the form of pulvules was distinctly beneficial

The dose is 0 05 grammes In many cases I have noticed that the pain disappeared within 15 minutes If however, the pain had not disappeared *after one hour another pulvule* was given and usually the patient then had relief for 24 hours and in many instances there was no return

These reactions relieving drugs are a *very essential* and a very *excellent* part of the equipment of the person treating leprosy They help one in a marked degree to continue the treatment with very little interruption and prevent much suffering

(*f*) Counter irritation This method of treatment is the most useful adjunct to the *general treatment* Everyday, each patient after his bath, rubbed over his whole body with crude Hydnocarpus oil He was encouraged to do this while in the sun It is doubtful whether any actual absorption of the oil takes place but the *friction plus inunction* has a general good effect on the patients They testify to this themselves.

In addition to the oil counter irritation with Trichlor acetic acid was carried out It proved most beneficial *for the local treatment* of the leprotic lesions It was used in

three strengths viz 1 in 1 solution, 1 in 3 and 1 in 5 made up in distilled water The 1 in 1 solution was used for painting on nodules. The 1 in 3 solution was found the most useful for raised erythematous patches anywhere on the body except the face, where a 1 in 5 solution had to be used Some lesion was painted every injection day but it was found better not to paint the same lesion oftener than once in 10 days

(g) Length of Treatment This necessarily varies in different cases For instance, the duration of the disease before treatment was begun must be taken into account and also the rapidity with which the active signs have disappeared Generally speaking treatment ought to be continued until all active signs of the disease have been absent for from 6 months to one year One must therefore consider the criteria of the disappearance of active signs and in the rules for discharge of Government officials under treatment in the Lady Wellington Leper Settlement they are made clear—these rules are as follows—

No government official must be discharged unless

(a) No new lesions have appeared for at least 6 months

(b) Old lesions have shown no tendency to spread or other form of activity over a period of six months

(c) Repeated bacteriological examina tions of skin, mucous membranes and lymph nodes on puncture have proved negative over a period of six months

These rules are laid down from a public health point of view From the therapeutic point of view two years should be substituted for the six months

It is wise to see that every patient satisfies these conditions stated above before discharge and he ought to return at least every 3 months for a period of two years for re examination This aspect of the after care of the treated case is dealt with more fully under the industrial therapy

3 The Treatment of Secondary Lesions or Sequelæ The chief of these which require care are, true leprotic ulcers, trophic ulcers, nerve enlargement, and nerve

abscess, lesions of the eyes, nose and throat and various deformities

i **Trophic ulcers** These are usually found in the more advanced cases but present a problem in treatment nevertheless They are not commonly found in the feet The method of treatment adopted at Chingleput was to wash the surface of the ulcer with Hydrogen peroxide, and then after allowing this to act for a little to wash it off dry the part and dress with boroiodoform powder 1 in 3 Should a sinus be present I have found the injection of weak Tr iodine into the sinus to promote more rapid healing in some cases Unfortunately it was only a temporary healing and I usually found that true healing only occurred after I had removed the necrosed bone while in many cases the only cure was by amputation of the affected part Where repeated attacks of lymphangitis had occurred amputation was necessary to save the patient's life Prolonged exposure to sunlight often gave much relief For such cases and possibly for all lepers treatment by ultraviolet rays would in my opinion be extremely beneficial

ii **True leprotic ulcers** These are usually the result of breaking down nodules

either as a consequence of reactions or occurring during the course of ordinary treatment. With the application of the creosoted esters they usually clear up quite rapidly in whatever part of the body they may occur

iii *Nerve enlargement and nerve* abscess The most commonly thickened of the superficial nerves are the great auriculars, the ulnars and the superficial peroneals Those most commonly giving rise to pain or abscess formation requiring active treatment are the ulnars Nerve pain most commonly occurs during a period of reaction and the treatment has already been dealt with Where the pain continues however, and the nerve becomes greatly enlarged causing acute neuritis, the writer found that the only way to give relief was to cut down over the affected nerve and *isolate the sheath from the* surrounding tissue, stretching the nerve at the same time. This simple operation which can be done under local anæsthesia gives remark able relief and has been the means on several occasions of preventing the development of contracted fingers in the affected limbs Should the inflammation go on to abscess formation, an occurrence which I found was very apt

to occur during treatment with Pot. iodide, the sheath of the nerve must be exposed, incised and the abscess drained. The nerve must also be freed from the surrounding tissues to which it has become adherent

iv Lesions of the eyes Eye disease in the leper is always a cause for great anxiety, and at the first sign of any trouble, the first step to be taken is to stop all antileprotic treatment and commence remedial measures The lesions in the eye may be due to the actual extension of infection from the surrounding skin causing a leprous infiltration of the conjunctiva and gradually spreading on to the cornea One may even get nodules forming on the iris or a general infiltration of this structure Treatment of these conditions in a leper once they have gained ground is extremely difficult and the most that one can hope for is to lessen the destructive process The sight may be quickly endangered and occlusion of the pupil may occur One must use atropine freely to prevent adhesions.

Where ordinary iritis or conjunctivitis have developed, provided reaction is guarded against, the condition usually clears up quickly

I have found the use of the following ointment very beneficial in all eye conditions in leprosy It diminishes the pain considerably and has a tendency to clear up any slight opacities which have remained It is as follows —

R Dionin gr ½

Atropine sulphate gr ½

Ung Hydrag Flav oz j

Vaseline oz j

The patient ought also to receive a good purge and if necessary the use of leeches to the temple may be indicated

In the very advanced cases of leprosy where paralysis of the orbicularis palpebrarum has occurred causing an ectropion of the lower eyelid and loss of sensation in the cornea, the patient is in danger of developing ulcers on the cornea because of the constant exposure to dust and other irritants He must *be provided with adequate goggles having* sidescreens At night when he retires a compress soaked in weak saline solution laid over the eyes prevents irritation and is extremely soothing to the patient I have eesn a *patient* quite unable to get rest and

sleep without this simple application Plastic operation later may restore to a certain extent the protective functions of the eyelids

x Lesions of the nose and throat Lepers suffer frequently from a dry rhinitis with scab formation This is no doubt due to the same condition as is present in the skin lesions namely anhydrosis Nodules may form in the nostrils and breaking down, form ulcers These ulcers are sometimes difficult to heal and in the course of time are apt to lead to perforation of the septum In most leper institutions a standard routine for the treatment of nasal lesions is adopted and after trial of many I consider it most efficacious so far This consists of irrigation of the nasal cavities with warm boracic lotion followed by the installation of a few drops of the following mixture —

Hydnocarpus oil	1 part
Olive oil	9 parts
Creosote	1 part
Camphor	1 part

The ordinary creosoted esters used for injection treatment are also useful I have also found the use for the following distinctly

beneficial in many cases Insert a pledget of wool soaked in glycerin in the nostril and leave it for about half an hour The crusts then usually come off easily Then wash with saline and paint with a 4% solution of metallic iodine in hydnocarpus esters This process may be repeated every day until the condition clears up As regards the throat lesions, I consider that infiltration and nodular formation account for most of them Hoarseness is a well known phenomenon among lepers and is due no doubt to a ch laryngitis caused by definite infiltration It is noteworthy that the worst throat conditions are found in those cases with extensive affection of the nasal passages, pointing no doubt to a direct infiltration from nose to throat Spraying or any other medicinal treatment is of little avail Should respiratory obstruction occur due to oedema of the *epiglottis during* a *reaction* tracheotomy is the only means of giving the patient relief and many recover quite rapidly after the operation, the swelling going down and the infitration and nodular formation receding to such an extent that the normal function of the throat is markedly restored.

vi. **Deformities** Much can be done by operation to restore function to contracted fingers or even by amputating a finger or toe to give a useful hand or foot which before was almost useless

Plastic operations do much to remove the disfigurement of depressed noses and paralysed eyelids Infiltration of the lobes leads to a great enlargement and as the swelling subsides pendulous lobes remain which stamp the patient as a leper wherever he goes I earned the gratitude of very many of my patients by trimming the ears to normal size and shape using the special curved clamp as devised by Muir and made by Messrs Down Bros no anæsthetic is required as owing to the deep analgesia o the part and the pressure of the clamp cau es little or no pain

It should always be remembered durin, treatment of the leper that contracting fingers bone lesions and other commenci g d formities are going to lead to crippling conditions later unless watched carefully Massage and exercise ought to be commenced early a d I would suggest that a part of the equipment of every leper institution of the future should

be apparatus for ultra violet radiation which would prove exceedingly beneficial for the treatment of all types of ulcers specially the trophic ones, which are the cause of so much of the crippling and even death among lepers

4 Treatment of co existing diseases specially syphilis These diseases are usually called predisposing causes By lowering the resistance of the patient they favour the spread of the mycobacterium in leprae Appropriate treatment of the conditions found *almost invariably leads to a decided improvement* in the leprous condition It is in the *treatment of these concomitant diseases* that one realises that mass treatment does not give the best results Each case must be studied individually and attention must not be directed *solely upon the administration of routine* special drugs In the settlement under review every case *on admission was very carefully* examined for signs of existing disease or *other debilitating conditions Thorough examination* of the stools urine and blood was carried out *The chief predisposing causes* discovered which required treatment were *syphilis, hookworm,* malaria, *the dysenteries,*

tuberculosis and nephritis Other skin diseases also required treatment of the success of the special measures though they were on the whole perhaps less important from the point of view of seriously retarding the special treatment The chief of the skin diseases met with were tinea and scabies It is not within the scope of this thesis to give the treatment of these conditions which follows the usual methods, except to stress the fact that greater care in the grading of the doses of the special antileprosy drugs is essential Even suspension of the special treatment for a period may be called for in some cases according to the condition of the patient

In the case of syphilis however, the treatment now available enables the two diseases to be treated concurrently, the result in most cases being a very rapid improvement in the leprous condition For some time there was much controversy as to whether all Wassermann positive cases in leprosy were necessarily suffering from syphilis.

In 1924 Lloyd, Muir and Mitra published their findings in connection with the part played by co existing syphilis in the causation of positive Wassermann reactions in leprosy.

They noted the power of antisyphilitic treatment to remove the positive Wassermann in cases of leprosy and they concluded that syphilis was an important *complicating factor in leprosy* and this is true in my cases as well, and that antisyphilitic treatment should be given in all cases of leprosy with a positive Wassermann reaction In 1926 Muir introduced treatment of syphilis in lepers by a drug then known as avenyl This drug had the advantage of being soluble in Hydnocarpus Wightiana oil Muir had already noted by a series *of experiments that no effect* was produced on the Wassermann reaction by long courses of hydnocarpus oil without Hg 33

In 1927 Lloyd, Muir and Mitra in carrying out experiments with avenyl stated that the effect of antisyphilitic treatment was a fair increase of the syphilis factor where leprosy was present They also suggested the use of the Kahn test for syphilis in leprosy because of the fact *that it did not yield any* false positives in the latter disease due to experimental factors and yet served in most cases to detect syphilis They recommended that every case of leprosy before giving antileprotic treatment should be serologically

examined for the presence of syphilis and that the Kahn test should be used for this purpose. The test is simple and requires very little apparatus thus making it most suitable for employment in small laboratories connected with leper institutions. Every case in the Lady Wellington Settlement before this finding and since had his blood tested by the Kahn method and if found positive was given antisyphilitic treatment. The great advantage of avenyl as has already been mentioned is the fact that it is soluble in hydnocarpus oil and there is no danger from reaction as was the case in some of the arsenicals previously tried. The mixture for injection is made up as follows:—

Hydnocarpus Wightiana	96 c c
Avenyl	0 25 Gms
Creosote (doubly distilled)	4 c c

The avenyl is placed in a mortar and just sufficient of the oil added to make a paste. The paste is mixed thoroughly and then the oil is gradually added. The mixture which is turbid is then transferred to a flask and placed in a water bath where after half an hour of heating it finally clears. The creosote is now added and the whole is

sterilised in an autoclave at 120° C for half an hour when it is ready for injection

Injections are given twice a week by the infiltration method and in the same dosage as the esters beginning with 1 c c and increasing at each injection by 1 c c until 10 c.c are reached This constitutes a course At the end of one month the Kahn or the Wassermann *reaction is taken again and if* positive the course is repeated In fact the course can be repeated as often as necessary until the blood becomes negative The same course can be given to children as to adults. If preferred the avenyl may be dissolved in the *esters or equal quantity of Hydnocarpus Oil* and esters may be used I always prefer to use the pure oil in order to avoid any possibility of reaction occurring Although very mild reactions are beneficial, I do not consider any reaction beneficial or safe in the presence of other disease

In cases which do not respond to Avenyl, sulfarsenol may be tried The course of the latter which I gave consisted of six injections—one injection per week—the patient receiving an injection of pure creosoted *Hydnocarpus* Oil on the other *injection day* of the week

The injection was given subcutaneously by infiltration I found reactions never occurred when using this drug Mercurial inunction may be carefully administered while giving sulfarsenol or alternating injections of Avenyl in oil and sulfarsenol may prove efficacious. The sulfarsenol course is as follows —

Dose	Amount of sulfarsenol	Distilled Water
1 No 5	30 Grs.	2.5 c.c.
2 „ 6	36 „	3 c.c
3 „ 7	42 „	3.5 c.c.
4 „ 8	48 „	4 c.c
5 „ 9	54 „	4.5 c.c
6 „ 10	60 „	5 c.c

Very lately various gold preparations are being used for this disease with varying success Different persons have different experience as regards results but never the less they are encouraging I personally prefer solganol B It is given intramuscularly every week as follows

First and second week 0.01 Gm
Third and fourth week 0.05 Gm
Fifth and sixth week 0.01 Gm

It is to be remembered that in the use of heavy metals for treatment, the doses should be small and repeated Bigger doses

are harmful Lead in treatment for cancer has fallen into disrepute not because of its unsatisfactory action, but because of big dosage used with resultant unpleasant symptoms

The chief indications for gold therapy are

(i) The presence of leprotic affections of the eyes,

(ii) The production of lepra fever by the usual methods of treatment I hope that in not very distant date this line of treatment will become established

CHAPTER VI.

Summary and Conclusions

It is useless to attempt to cure a leper when he is leading an unnatural life, as cure under the conditions will be impossible and the time and drugs will go to waste. Many lepers will never show manifest lesions of the disease if they live under congenial circumstances, and many will improve without medicines, as their organs of the body can work to a better advantage than otherwise. Hence it is very imperative to put a leper in a healthy, and sanitary place, regulate his diet giving him plenty of nutritive easily digestible food, and plenty of fruits and vegetables and good supply of milk. He should have daily bath All associated diseases should be treated properly particularly intestinal parasites. The leper should be given encouragment and he should not be given a chance of thinking himself an outcaste. It is always better to give him some suitable employment so as to give him no time to think about his malady

Under these conditions all patients will show improvement when antileprotic treatment

is given at the same time

The special treatment of leprosy given above should be carried out until long after all signs of disease have disappeared.

As regards recurrence of the disease, it depends on three factors length of treatment, immunity of the patient and his ability to continue to lead a healthy life In this respect this disease is very much like tuber culosis, and all precautions to be taken to prevent a second attack of phthisis, are applicable in this disease

The results are better if the treatment is started in the early stage of the disease The patient can continue his work during treatment in the majority of cases This is very helpful in treatment, as he will worry less

Duration of treatment In the first state the symptoms disappear quickly under antileprotic treatment, combined with general measures detailed above The treatment must continue for atleast three months after apparent cure In the second stage the same rule applies, but the treatment to continue long after manifest symptoms have gone. Pot iodide is given in small doses to determine the

presence of sequestrated foci, as it will give rise to focal reaction

In the third stage the treatment should continue till all skin and mucous lesions have disapp ared, and *then the permanent lesions* can be allowed to pass as cured by them selves. Briefly the treatment should continue for one year in the early stage, for two years in the second stage, and for three years in the third stage But the case should not be considered as cured till all the symptoms have disappeared and treatment has continued for six months after apparent cure, and till Pot. iodide test has given negative result.

LEPROSY

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